US009458634B2

(12) **United States Patent**
Derelov

(10) **Patent No.: US 9,458,634 B2**
(45) **Date of Patent: Oct. 4, 2016**

(54) **BUILDING PANEL WITH A MECHANICAL LOCKING SYSTEM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/709,913**

(22) Filed: **May 12, 2015**

(65) **Prior Publication Data**

US 2015/0330088 A1 Nov. 19, 2015

(30) **Foreign Application Priority Data**

May 14, 2014 (SE) 1450568

(51) **Int. Cl.**
E04F 15/02 (2006.01)
E04B 5/00 (2006.01)
E04F 13/08 (2006.01)

(52) **U.S. Cl.**
CPC ***E04F 15/02038*** (2013.01); ***E04F 13/0894*** (2013.01); ***E04F 15/02022*** (2013.01); *E04F 2201/0146* (2013.01); *E04F 2201/023* (2013.01); *E04F 2201/043* (2013.01); *E04F 2201/044* (2013.01); *E04F 2201/0523* (2013.01); *E04F 2201/0535* (2013.01); *E04F 2201/0547* (2013.01); *E04F 2201/0552* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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(57) **ABSTRACT**

A set of essentially identical panels (**1**, **1'**), such as building panels, provided with a mechanical locking system including a displaceable tongue (**30**), which is arranged in a displacement groove at a first edge of a first panel (**1**). A second panel is provided with a tongue groove at a second edge. The displaceable tongue is configured to cooperate with the tongue groove (**20**) for locking together the first and the second edge. The displaceable tongue has a spring constant that varies along the length of the tongue.

19 Claims, 6 Drawing Sheets

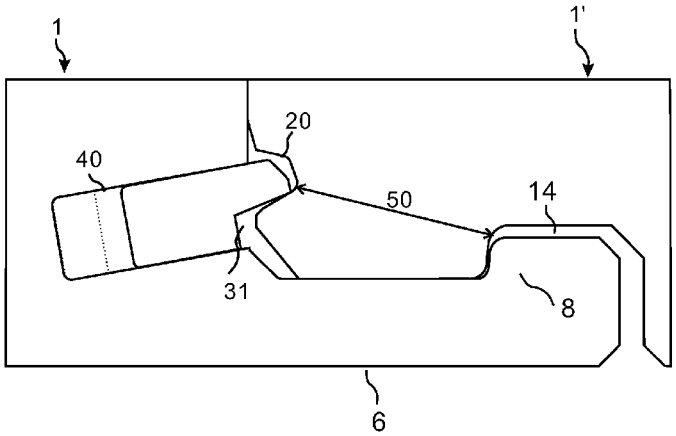

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FIG 1

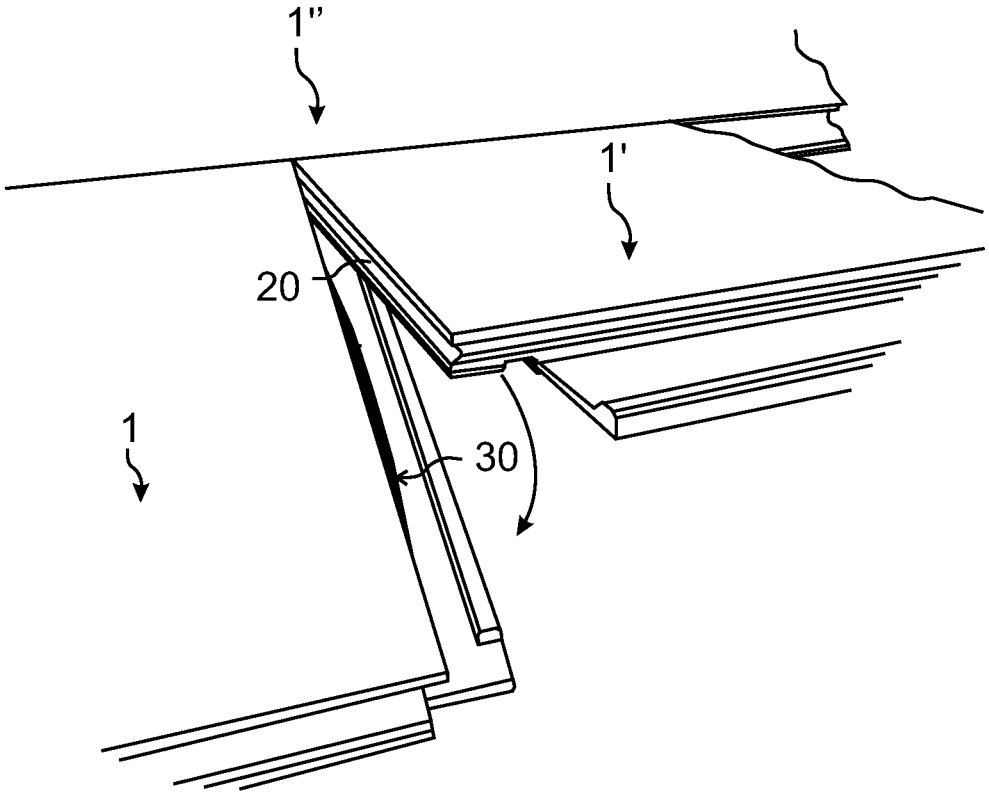


FIG 2A

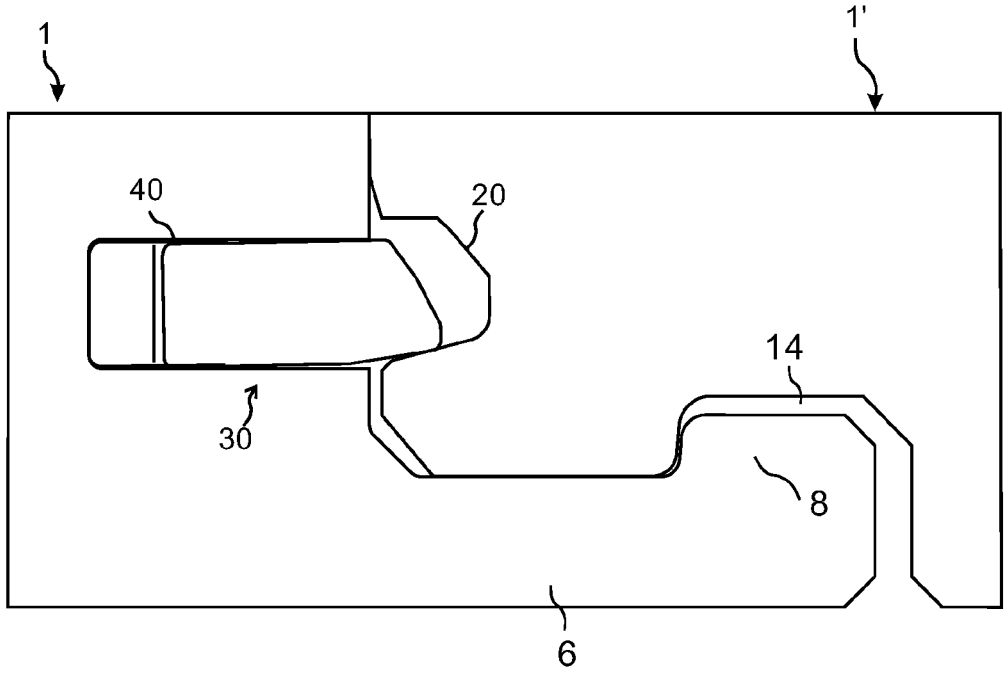


FIG 2B

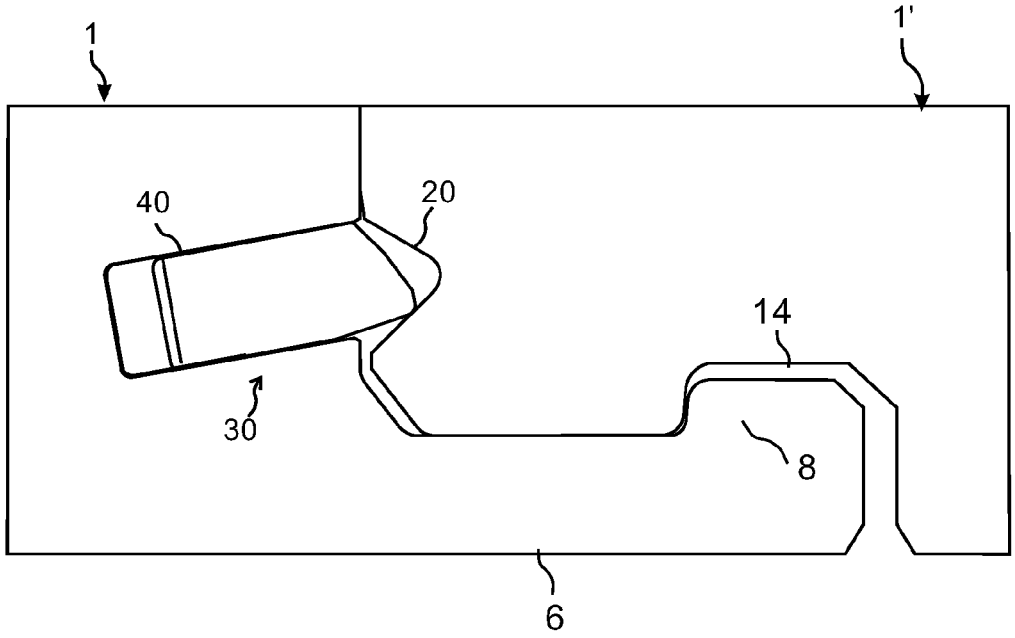


FIG 3A

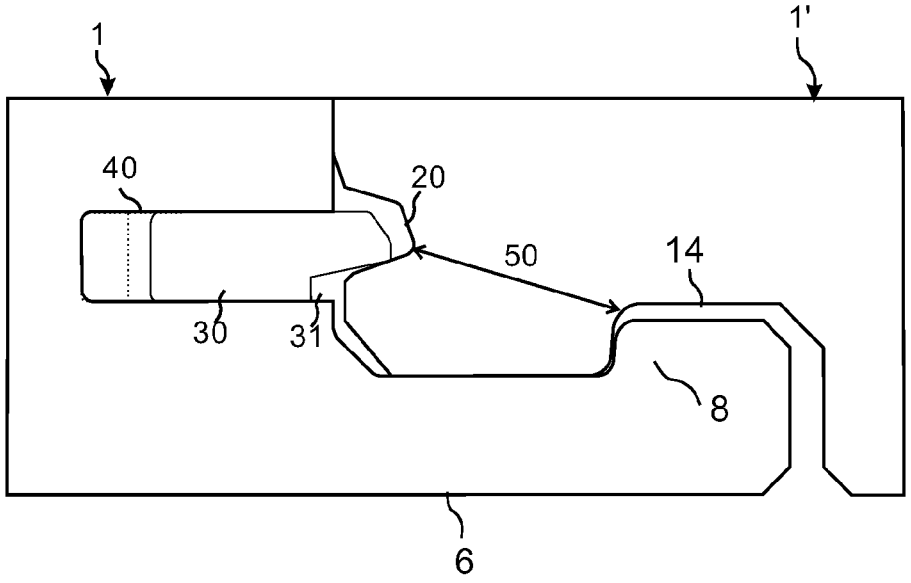


FIG 3B

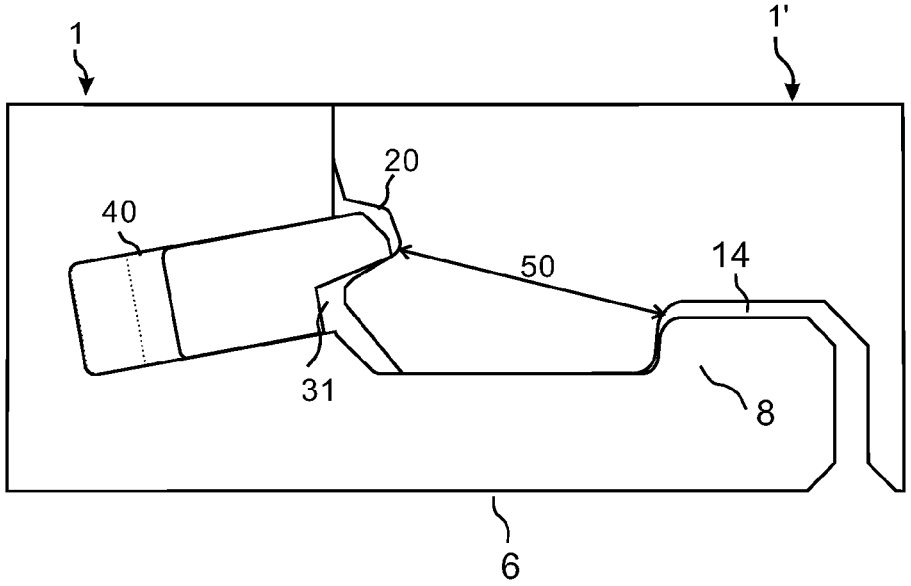


FIG 4A

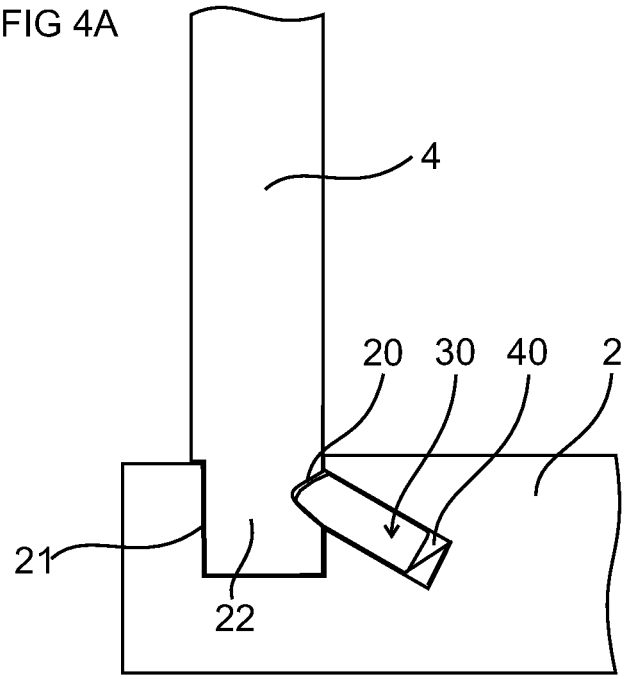


FIG 4B

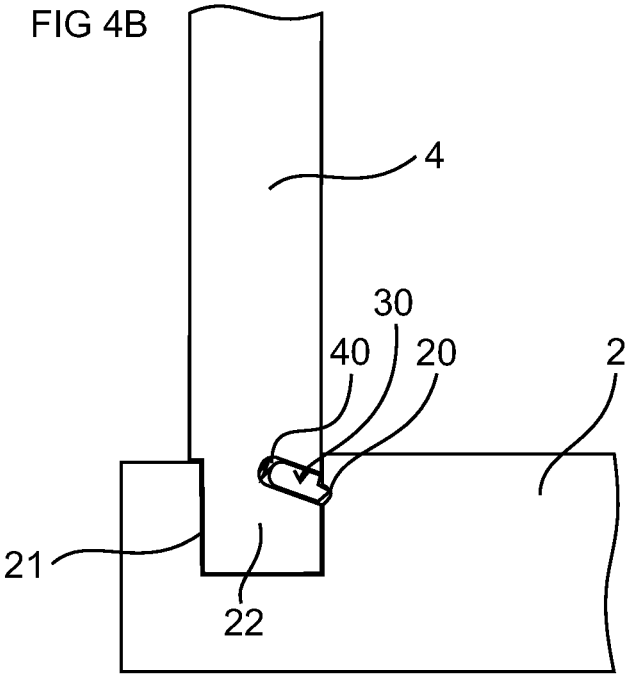


FIG 5A

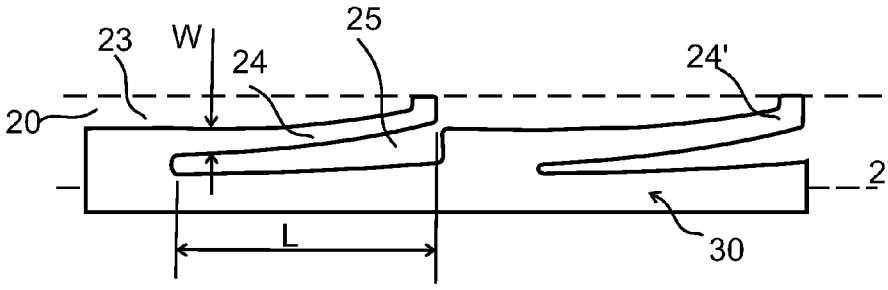


FIG 5B

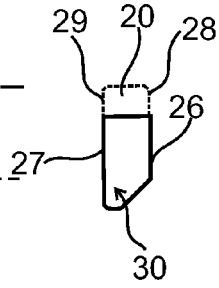


FIG 5C

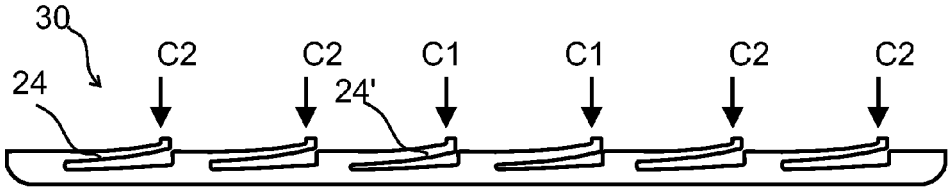


FIG 5D

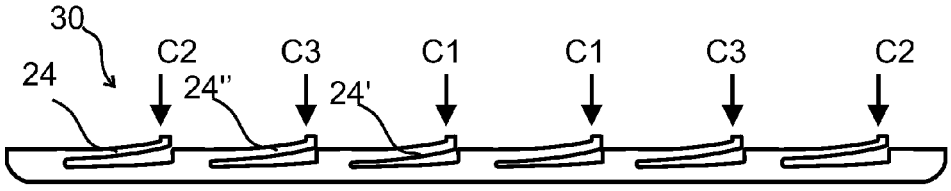


FIG 5E

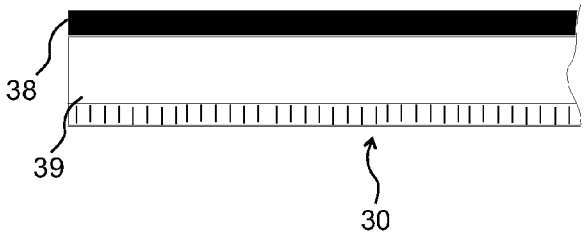


FIG 5F

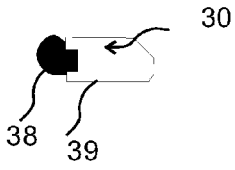


FIG 6A

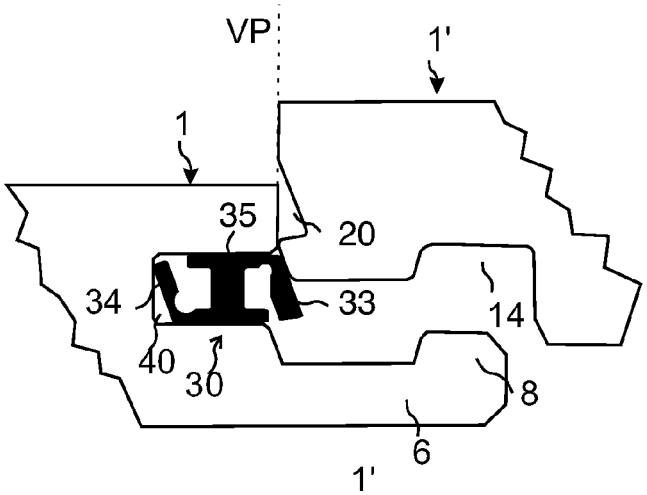


FIG 6B

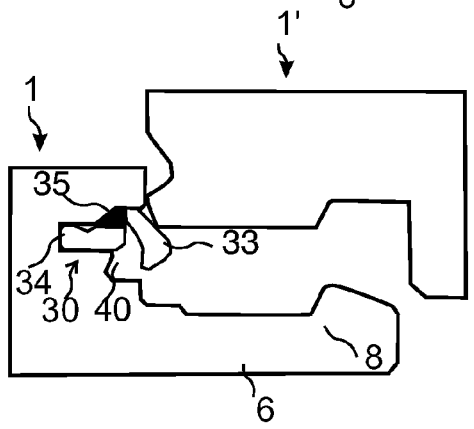


FIG 6C

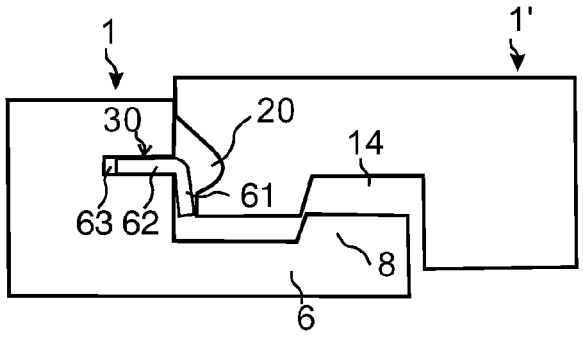
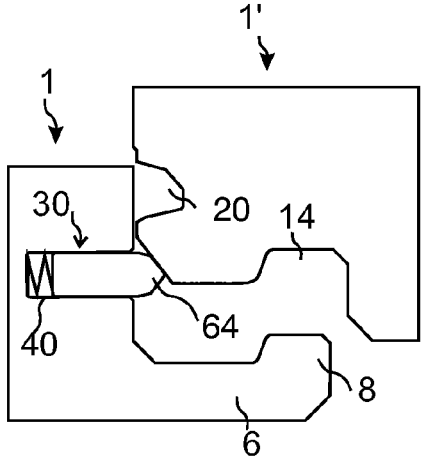


FIG 6D



BUILDING PANEL WITH A MECHANICAL LOCKING SYSTEM

The present disclosure relates to a panels such as a building panels, floorboard, wall panels, ceiling panels, furniture components or the like, which is provided with a mechanical locking system.

TECHNICAL BACKGROUND

Building panels provided with a mechanical locking system comprising a displaceable and resilient tongue cooperating with a tongue groove for vertical locking is known and disclosed in, e.g., WO2006/043893, WO2007/015669 and WO2009/066153. The tongue is a separate part and is made of, e.g., plastic and inserted in a displacement groove at an edge of a panel. The tongue is pushed into the displacement groove during an assembling of the panels when the panels are moved vertically with respect to each other, and springs back into the tongue groove of an adjacent panel when the panels have reached a locked position.

Although most of the description relates to floor panel, the description of techniques and problems thereof is applicable also for other applications, such as panels for other purposes, for example wall panels, ceiling panels, furniture, etc.

A drawback with the known locking system is that the tongue may spring back with a lower force than desired.

The above description of various known aspects is the applicant's characterization of such, and is not an admission that any of the above description is considered as prior art.

SUMMARY

It is an object of certain embodiments of the present disclosure to provide an improvement over the above described techniques and known art. Particularly, the strength of the known locking system is improved by embodiments of the invention.

A further object of the disclosure is to provide panels with a locking system comprising a displaceable tongue that springs back with a greater force, without making the assembling of the panels more difficult.

At least some of these and other objects and advantages that will be apparent from the description have been achieved by a set of essentially identical panels provided with a mechanical locking system comprising a displaceable tongue, which is arranged in a displacement groove at a first edge of a first panel. The displacement groove is preferably open in a horizontal direction. The displaceable tongue is configured to cooperate with a first tongue groove at a second edge of an adjacent second panel, for locking the first and the second edge in a vertical direction. The displaceable tongue is of a longitudinal shape and resilient with a spring constant that varies in the longitudinal direction of the displaceable tongue. A middle section in the longitudinal direction of the displaceable tongue has a higher spring constant than a first edge section of the tongue.

The lower spring constant at the first edge section may facilitate assembling of the first and second panel at the first and the second edges while the higher spring constant at the middle section may provide an improved locking. The higher spring constant may also provide a higher click sound when the displaceable tongue enters into the tongue, groove. The higher click sound may be an indication to an assembler of the panels that the panels are properly assembled.

The displaceable tongue may function in a similar manner as a spring. When a spring is compressed, the force it exerts is essentially proportional to its change in length. The rate or spring constant of a spring is the change in the force it exerts, divided by the change in deflection of the spring. An extension or compression spring has units of force divided by distance, for example N/m. The displaceable tongue may be compressed in its width direction.

The displaceable tongue may also be provided or function in a similar manner as a torsion spring that has units of torque divided by angle, such as Nm/rad. The displaceable tongue may alternatively function as a combination of a spring and a torsion spring.

Depending on the design and required operating environment, any material may be used to construct a spring, as long as the material has the required combination of rigidity and elasticity.

The spring constant of the middle section may also be higher than a spring constant of a second edge section of the tongue.

An inner long edge of the tongue may comprise protrusions arranged in the displacement groove, wherein the protrusions are bendable. A first of the protrusions may be arranged at the middle section and a second of the protrusions may be arranged at the first edge section, wherein the bending resistance of the first of the protrusion is greater than the bending resistance of the second protrusion. A third of the protrusions may be arranged at the second edge section, wherein the bending resistance of the first of the protrusion may be greater than the bending resistance of the third protrusion. A thickness of the first protrusion may be greater than a thickness of the second protrusion. A thickness of the first protrusion may be greater than a thickness of the third protrusion.

The displaceable tongue may be provided with a symmetrical outer edge. An upper and a lower side of the outer edge are preferably both provided with a surface and a surface that may function as either a locking surface or a guiding surface. This embodiment may have the advantage that the displaceable tongue may be turned upside-down with the same guiding and locking function.

The mechanical locking system may comprise a first locking strip, at the first or the second edge, provided with a first locking element configured to cooperate with a first locking groove at the other of the first or second edge for locking the first and the second edge in a horizontal direction.

The panels may be rectangular and the mechanical locking system may comprise a second locking strip, at a third or fourth edge, provided with a second locking element configured to cooperate for horizontal locking with a locking groove at the other of the third of fourth edge of an adjacent third panel. The third or the fourth edge is preferably provided with a second tongue configured to cooperate for vertical locking with a second tongue groove at the other of the third of fourth edge of an adjacent third panel.

The mechanical locking system at the third and the fourth edge may be configured to be assembled by an angling motion.

The mechanical locking system at the first and the second edge may be configured to be assembled by a vertical motion.

The panels may be floorboards, wall panels, ceiling panels, a furniture component, or the like.

The core of the panels may be a wood-based core, preferably made of MDF, HDF, OSB, WPC, plywood or particleboard. The core may also be a polymer-based core comprising thermosetting plastic or thermoplastic, e.g., vinyl or PVC. The plastic core may comprise fillers.

The front face of the panels is preferably provided with a decorative layer and the back face is preferably provided with a balancing layer.

The edge of the panels, of which parts of the locking system, such as the first and the second locking strip, the first and the second locking element, the first and the second locking groove and the first and the second tongue groove, may be made, may comprise the core material.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will by way of example be described in more detail with reference to the appended schematic drawings, which show several embodiments of the present invention.

FIG. **1** shows assembling of floorboards provided with a locking system comprising a displaceable tongue.

FIGS. **2**A-**2**B show cross sections of embodiments of the locking system.

FIGS. **3**A-**3**B show cross sections of embodiments of the locking system.

FIGS. **4**A-**4**B show two perpendicular assembled panels provided with embodiments of the locking system.

FIGS. **5**A-**5**F show embodiments of the displaceable tongue.

FIGS. **6**A-**6**D show cross sections of embodiments of the locking system.

DETAILED DESCRIPTION

An embodiment of a mechanical locking system for building panels, which comprises a displaceable tongue **30** cooperating with a first tongue groove **20** for vertical locking of a first edge of a first panel **1** with a second edge of a second panel **1'**, is shown in FIG. **1**. The displaceable tongue **30** is a separate part and is made of e.g. a polymer material, and is inserted in a displacement groove **40** at the first edge of the first panel **1**. The displaceable tongue **30** is pushed into the displacement groove **40** during a vertical assembling of the first and the second edges of the panels, and springs back into the first tongue groove **20** at the second edge of the second panel **1'** when the panels have reached a locked position. The displaceable tongue **30** is of a longitudinal shape and has a spring constant that varies in the longitudinal direction of the displaceable tongue **30**. A third and a fourth edge of the panels are provided with a locking system, which enables assembling to an adjacent panel **1"** by an angling movement, to obtain a simultaneous assembling of the first and the second edges and the third and the fourth edges.

FIGS. **2**A-**2**B and **3**A-**3**B show in a locked position cross sections of different embodiments of the mechanical locking system provided at the first and second panels **1**, **1'**. A displaceable tongue **30** is arranged in a displacement groove **40** at the first edge of the first panel **1**. The displaceable tongue **30** cooperates with a first tongue groove **20**, which is formed at the second edge of the second panel **1'**, for vertical locking of the panels **1**, **1'**. A first locking strip **6** with a vertically protruding first locking element **8** is formed at the first edge of the first panel **1**. The locking element **6** cooperates with a first locking groove **14**, formed in the edge of the second panel **1'**, for horizontal locking of the panels **1**, **1'**.

An embodiment of the displaceable tongue **30**, which is shown in FIG. **3**A-**3**B, is provided with a recess **31** at an outer tip of the displaceable tongue. The recess **31** makes it possible to have a smaller first tongue groove **20** and an increased distance **50** between the first tongue groove **20** and the locking groove **14**. The increased distance may improve the strength of the mechanical locking system. Embodiments of the mechanical locking system may have a displacement groove **40** that extends in a direction essentially parallel to an upper surface of the panels, as is shown in FIG. **2**A and FIG. **3**A. The displacement groove may alternatively extend at an angle to the upper surface of the panels, as is shown in FIGS. **2**B and **3**B. The angled displacement groove **40** may have the advantage of the increased distance **50** between the first tongue groove **20** and the locking groove **14**.

Embodiments of the mechanical locking system may be used to lock together a first panel **2** and a second panel **4** that are arranged essentially perpendicular to each other. An edge section **22** of the first panel **4** may be arranged in an edge section groove **21** of the second panel **2**. FIG. **4**A shows an embodiment with the displacement groove **40** arranged in the edge section groove **21** and the tongue groove **20** arranged at the edge section **22**. FIG. **4**B shows an embodiment with the displacement groove **40** arranged at the edge section **22** and the tongue groove **20** arranged in the edge section groove **21**.

Preferred embodiments of the displaceable tongue **30** comprise protrusions **24** at a long edge of the displaceable tongue **30**. The protrusions **24** are bendable and preferably arranged in the displacement groove **20**. The protrusions **24** are configured to bend when the displaceable tongue **30** is pushed into the displacement groove **40** and to spring back to obtain the locked position. FIGS. **5**A-**5**D show embodiments of the displaceable tongue **30** that is provided with a recess **25** at each of the protrusions. Each of the protrusions **24** is configured to be bent into a respective one of the recesses **25**. FIG. **5**B shows a cross section of the displaceable tongue **30** and the displacement groove **20** shown in FIG. **5**A. The displaceable tongue **30** may comprise an upper and a lower displacement surface **26**, **27** that is/are configured to cooperate with an upper and lower surface **28**, **29**, respectively, of the displacement groove **20**. FIG. **5**A shows a first protrusion **24** and a second protrusion **24'** with different thicknesses. The thickness of the second protrusion **24'** is larger than a thickness of the first protrusion **24** in order to obtain a larger spring constant of the second protrusion **24'**. In addition, or alternatively, the length of the first protrusion may also be longer than the length of the second protrusion **24'** in order to obtain a lower spring constant of the first protrusion **24**. The first protrusion **24** is preferably arranged at a first edge section of the displaceable tongue **30** and the second protrusion **24'** is preferably arranged at a middle section of the displaceable tongue **30**. An advantage with a lower spring constant at an edge section may be that the force required for assembling is initially lower if panels are installed, e.g., as is shown in FIG. **1**. An advantage with a high spring constant at the middle section may be that the spring force that forces the panels together is higher and a difference in level at the middle section of the first and the second edge, due to e.g. warped panels, may be levelled out. Differences in level at the edge sections of the first and second edge may be levelled out by the locking system at the third and forth edge.

FIG. **5**C shows an embodiment of the displaceable tongue **30** comprising protrusions with a first spring constant C**1** at the middle section of the displaceable tongue **30** and protrusions **24** at the first and the second edge sections with a second spring constant C**2**. The first spring C**1** constant is larger than the second spring constant C**2**. The first spring constant may be in the range of about 1.1 to about 5 times

as large as the second spring constant, preferably about 1.5 to about 3 times as large as the second spring constant, and most preferably about twice as large as the second spring constant. FIG. **5**D shows that the displaceable tongue may comprise protrusions with a spring constant C**3** that is between the first and the second spring constant.

During assembly, the displaceable tongue may be displaced about 0.5 to about 3 mm, and the spring constant of the protrusion **24** at the first edge section of the tongue is preferably in the range of 0.1 N/mm to about 10 N/mm, and more preferably in the range of 1 N/mm to about 4 N/mm.

FIGS. **5**E and **5**F show that the displaceable tongue **30** may comprise an inner flexible part **38** and an outer stiffer part **39**. The spring constant may be varied in the longitudinal direction of the displaceable tongue by having different thickness of the flexible part or by having different material of flexible part. FIG. **5**E shows a cross section of the displaceable tongue shown in FIG. **5**D.

FIG. **6**A-**6**B show embodiments of the displaceable tongue in a cross section during assembling of a first and a second panel. The embodiments of the displaceable tongue comprise three sections, an inner section **34**, an outer section **33** and a middle section **35** connected to each other. The sections comprise preferably a polymer material. The outer and inner sections **33** and **34** are formed from a more rigid material than the middle section **35**, which provides the major flexibility to the displaceable tongue **30**. The middle section may be of a rubber like material and may also be used as a friction connection in order to prevent the flexible tongue from falling out of the displacement groove **40**. The middle section **35** may function as a torsion spring. The outer section **33** preferably protrudes outside a vertical pane VP at the upper adjacent joint edges of the panels **1**, **1'**. The material and/or thickness of parts of the displaceable tongue may vary in the longitudinal direction of the displaceable tongue **30** to obtain the desired variation of the spring constant in the longitudinal direction of the displaceable tongue **30**. The inner section **34** may comprise a fixing edge that may be located at an upper or a lower part.

An embodiment of the displaceable tongue **30** may be of a V-shaped form as is shown in a cross section during assembling of a first and a second panel **1**, **1'** in FIG. **6**C. An outer and first leg **61** of the displaceable tongue **30** may protrude outside an edge of the first panel **1**. An inner and second leg **62** of the displaceable tongue **30** may be arranged in a fixation groove **63** at a first edge of the first panel **1**. A second edge of the second panel is provided with a tongue groove **20**. The first leg **61** is configured to cooperate with the tongue groove **20** for locking in a vertical direction. The thickness of the first leg **61** may vary in the longitudinal direction of the displaceable tongue **30** to obtain the desired variation of the spring constant in the longitudinal direction of the displaceable tongue **30**. The first leg **61** may point downwards when the flexible tongue **30** is provided at an edge of a panel comprising a strip **6** and a locking element **8**. The first leg **61** is pushed downward during assembling of the first and second panels **1**, **1'**.

Alternatively, the first leg **61** may point upwards when the flexible tongue **30** is provided at an edge of panel comprising a locking groove.

An embodiment of the displaceable tongue **30** with a symmetric outer edge **64** is shown if FIG. **6**D. An upper and a lower side of the outer edge are both provided with a surface that may function as either a guiding surface and a locking surface. The guiding surface of the upper side of outer edge **64** cooperates with a guiding surface of the second edge of the second panel **1'** during assembling of the first and the second panel **1**, **1'**. The locking surface of the upper side of outer edge **64** cooperates with a locking surface of the tongue groove **20** at the second edge of the second panel **1'** in a locked position of the first and the second panel. The symmetric outer edge **64** may have the advantage that the displaceable tongue **30** has the same guiding and locking function also when the displaceable tongue is turned upside-down. An embodiment of the displaceable tongue with a first spring constant at the first edge section and a second spring constant and the second edge section may be turned upside down to change the position in the displacement groove of the first and the second edge section. The displaceable tongue is preferably positioned such that the edge section with lowest spring constant is the edge section with the earliest cooperation with the guiding surface of the second edge of the second panel **1'** during assembling of the first and the second panel **1**, **1'**.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention being limited only by the terms of the appended claims.

The invention claimed is:

1. A set of panels is provided with a mechanical locking system comprising a displaceable tongue, which displaceable tongue is arranged in a displacement groove at a first edge of a first of the panels, the displacement groove having an upper wall, a lower wall and a bottom wall between the upper wall and the lower wall, the displaceable tongue is configured to cooperate with a first tongue groove at a second edge of an adjacent second of the panels, for locking of the first edge and the second edge in a vertical direction,

wherein the displaceable tongue is of a longitudinal shape and resilient, and comprises a plurality of protrusions arranged in the displacement groove, each protrusion in the displacement groove protruding from a main body of the displaceable tongue in a substantially horizontal direction, the horizontal direction being perpendicular to the vertical direction, toward the bottom wall, a spring constant of the protrusions varies in the longitudinal direction of the displaceable tongue, and the protrusions at a middle section in the longitudinal direction of the displaceable tongue have a higher spring constant than the protrusions at a first edge section of the displaceable tongue.

2. The set of panels as claimed in claim **1**, wherein the displacement groove is horizontally open.

3. The set of panels as claimed in claim **1**, wherein the spring constant of the protrusions at the middle section is higher than a spring constant of protrusions at a second edge section of the displaceable tongue.

4. The set of panels as claimed in claim **1**, wherein the protrusions are bendable.

5. The set of panels as claimed in claim **4**, wherein a first of the protrusions is arranged at the middle section and a second of the protrusions is arranged at the first edge section, wherein bending resistance of the first of the protrusions is greater than bending resistance of the second of the protrusions.

6. The set of panels as claimed in claim **5**, wherein a third of the protrusions is arranged at the second edge section, wherein the bending resistance of the first of the protrusions is greater than bending resistance of the third protrusion.

7. The set of panels as claimed in claim **5**, wherein a thickness of the first of the protrusions is greater than a thickness of the second of the protrusions.

8. The set of panels as claimed in claim 6, wherein a thickness of the first of the protrusions is greater than a thickness of the third of the protrusions.

9. The set of panels as claimed in claim 1, wherein the mechanical locking system comprises a first locking strip at the first edge of the first panel or at the second edge of the adjacent second panel, the first locking strip provided with a first locking element configured to cooperate for horizontal locking with a first locking groove at the other of the first edge or the second edge.

10. The set of panels as claimed in claim 9, wherein the panels are rectangular and the mechanical locking system comprises a second locking strip at a third edge or a fourth edge of an adjacent third panel, the second locking strip provided with a second locking element configured to cooperate for horizontal locking with a second locking groove at the other of the third edge or the fourth edge of the adjacent third panel.

11. The set of panels as claimed in claim 10, wherein the mechanical locking system at the third edge and the fourth edge of the panels is configured to be assembled by an angling motion.

12. The set of panels as claimed in claim 1, wherein the mechanical locking system at the first edge and the second edge of the panels is configured to be assembled by a vertical motion.

13. The set of panels as claimed in claim 1, wherein the panels are building panels.

14. The set of panels as claimed in claim 1, wherein the spring constant of the protrusions at the middle section is 1.5 to 3 times higher than the spring constant of the protrusions at the first edge section.

15. The set of panels as claimed in claim 1, wherein the spring constant of the protrusions at the first edge section is in the range of about 0.1 to about 10 N/mm.

16. The set of panels as claimed in claim 1, wherein the spring constant of the protrusions at the first edge section is in the range of about 1 to about 4 N/mm.

17. The set of panels as claimed in claim 15, wherein the spring constant of the protrusions at the middle section is 1.5 to 3 times higher than the spring constant of the protrusions at the first edge section.

18. The set of panels as claimed in claim 16, wherein the spring constant of the protrusions at the middle section is 1.5 to 3 times higher than the spring constant of the protrusions at the first edge section.

19. The set of panels as claimed in claim 1, wherein the protrusions are spaced from each other in a direction along the longitudinal direction of the displaceable tongue.

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